OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

CHEMISTRY B (SALTERS)

- *Data Sheet for Chemistry B (Salters)* (inserted)

Other materials required:
- Scientific calculator

Duration: 1 hour 15 minutes

OCE/25640

F331

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.

  This means for example you should:
  - ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
  - organise information clearly and coherently, using specialist vocabulary when appropriate.
- You may use a scientific calculator.
- A copy of the *Data Sheet for Chemistry B (Salters)* is provided as an insert with this question paper.
- You are advised to show all the steps in any calculations.
- The total number of marks for this paper is **60**.
- This document consists of **12** pages. Any blank pages are indicated.

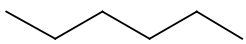
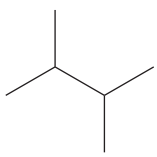
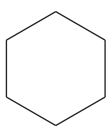
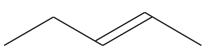
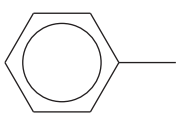
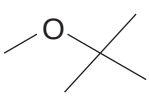
2

Answer **all** the questions.

1 Car fuels contain many different hydrocarbons and also compounds containing oxygen.

(a) (i) The table below shows some of the compounds used in car fuels.

Complete the table by filling in the spaces.

compound	**molecular formula**	**skeletal formula**	**homologous series**
hexane	C_6H_{14}		alkane
3-methylpentane	C_6H_{14}		alkane
	C_6H_{14}		alkane
cyclohexane	C_6H_{12}		
pent-2-ene	C_5H_{10}		
methylbenzene	C_7H_8		
2-methylpropan-2-ol	$C_4H_{10}O$		alcohol
2-methoxy-2-methylpropane	$C_5H_{12}O$		

[7]

(ii) Most of the above compounds are separated from crude oil. What name is given to this separation process?

..... **[1]**

(iii) What term is used to describe different compounds that have the same molecular formula?

..... **[1]**

(iv) Name an unsaturated compound in the table opposite.

..... **[1]**

(b) The table includes some branched alkanes. Branching affects the **octane number** of an alkane.

What tendency does octane number measure?

Give the effect of increased branching on octane number.

.....

.....

..... **[2]**

(c) The processes of cracking and reforming are used to improve the performance of hydrocarbons as fuels.

(i) Complete the equation below for the cracking of the hydrocarbon $C_{11}H_{24}$ to produce two of the hydrocarbons **in the table**.

$$C_{11}H_{24} \longrightarrow \text{.....} + \text{.....}$$ **[2]**

(ii) Give the equation for a **reforming** reaction that involves two of the compounds in the table.

[1]

[Total: 15]

2 A Russian agent died in London in November 2006, possibly as a result of drinking tea to which the radioisotope polonium-210 had been deliberately added. Polonium-210 has a half-life of 138 days.

(a) **(i)** Polonium-210 decays by emitting α-radiation.
Use the *Data Sheet* to write a nuclear equation for this α-decay.

[2]

(ii) It is thought that less than a microgram (1.0×10^{-6} g) of polonium-210 could be fatal. Calculate the number of moles of polonium in 1.0×10^{-6} g of polonium-210.

Give your answer to **two** significant figures.

number of moles = ... **[2]**

(b) Tiny amounts of polonium-210 were later found around London. Suggest **one** reason why contact with this polonium-210 was **unlikely** to pose a health risk.

.....

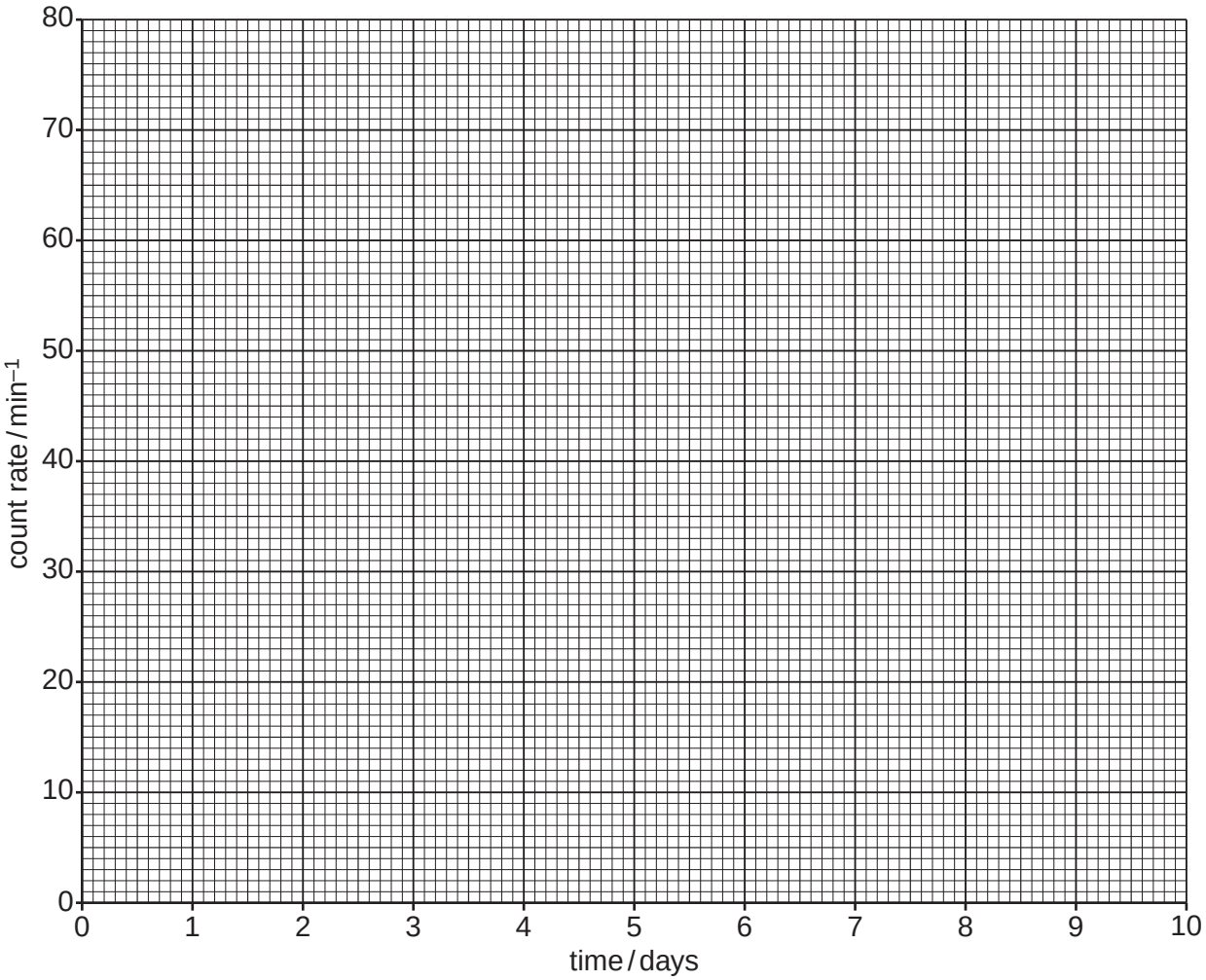
..... **[1]**

(c) A student measured the count rate of a **different** radioisotope over a period of one week. The measurements were taken at the same time each day. The results for this experiment are tabulated below.

time / days	**count rate / min^{-1}**
0	80
1	54
2	39
3	28
4	20
5	15
6	10

(i) Plot the results of the student's experiment on the graph paper on the next page. Draw a suitable line showing how the count rate reduces over a period of **10** days. **[3]**

5



(ii) Explain the term *half-life*.

Use your graph to measure the value of the half-life, in days.

Show your working on the graph.

.....

.....

half-life = ...days **[2]**

(iii) Suggest whether the half-life of this particular radioisotope would be suitable for its use as a 'tracer' in the body. Give your reasoning.

.....

.....

..... **[2]**

[Total: 12]

3 In March 1962, the English chemist Neil Bartlett reacted a red vapour called platinum hexafluoride, PtF_6, with the noble gas xenon. An orange–yellow solid formed as shown in the equation below.

$$Xe(g) + PtF_6(g) \longrightarrow XePtF_6(s)$$

(a) **(i)** Calculate the percentage by mass of platinum in PtF_6.

percentage by mass = ... % **[2]**

(ii) Calculate the volume of xenon gas, in cm^3 at room temperature and pressure, that would be needed to produce 10 g of $XePtF_6$ on reaction with excess $PtF_6(g)$.

One mole of gas at room temperature and pressure occupies 24 dm^3.

volume of xenon = ... cm^3 **[3]**

(b) **(i)** Before Bartlett's experiment, chemists had predicted that xenon was unreactive. Suggest why this prediction was made.

.....

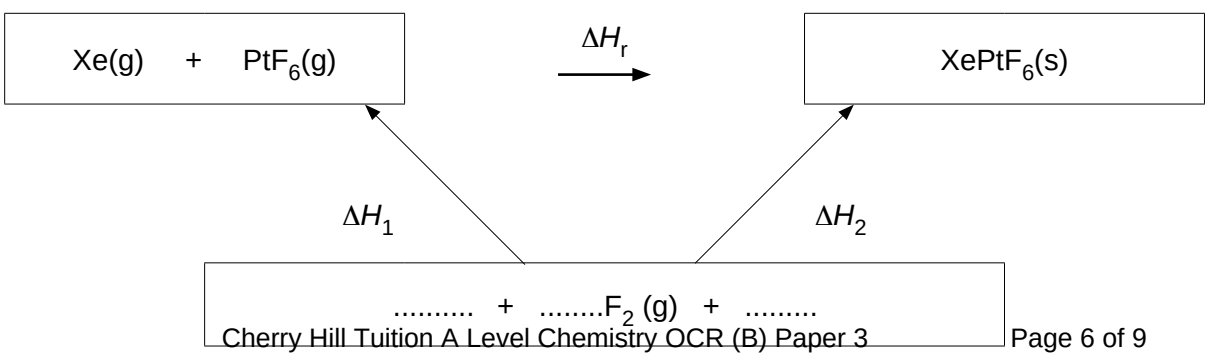
..... **[1]**

(ii) Up to that time a simple model had been used to explain why atoms of different elements react. Suggest why this had to be reviewed after Bartlett's experiment.

.....

..... **[1]**

(c) A value for the enthalpy change for Bartlett's reaction can be calculated using the enthalpy cycle below.



7

(i) ΔH_1 and ΔH_2 are the enthalpy changes of formation of PtF_6 and $XePtF_6$. Complete the enthalpy cycle by filling in the gaps in the box on page 6. **[2]**

(ii) Use Hess' law to write an expression relating the enthalpy change of reaction, ΔH_r, to ΔH_1 and ΔH_2.

..... **[1]**

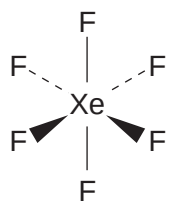
(iii) Explain why you would expect ΔH_r to be exothermic.

.....

..... **[1]**

(d) Bartlett's work soon led to several other noble gas compounds being prepared, including the gas xenon hexafluoride, XeF_6.

The diagram below is a representation of the shape of this molecule.



Explain the significance of the dotted lines and wedges in this diagram.

.....

..... **[2]**

(e) Give the group and period of the Periodic Table in which xenon is found. Explain how this information is related to the electronic structure of xenon.

.....

.....

..... **[2]**

[Total: 15]

4 Forest fires can be devastating, as large bush fires in Australia in recent years have shown. The ash that remains consists mainly of potassium carbonate that does not decompose in the fire.

(a) **(i)** Potassium forms 1+ ions in its compounds.

Write down the electronic configuration for the K^+ ion.

..... **[1]**

(ii) Limestone, impure calcium carbonate, $CaCO_3$, would have decomposed in the extreme heat of the fire.

Write down the equation for the decomposition of calcium carbonate.

Show state symbols.

[2]

(b) Both potassium and calcium carbonate give a characteristic flame colour on strong heating. Analysis of the flame colours shows them to consist of a series of coloured lines at specific frequencies.

(i) What name is given to these line spectra?

In your answer, you should use appropriate technical terms, spelled correctly.

..... **[2]**

(ii) Heating compounds produces these line spectra. Explain this in terms of changes between energy levels.

You should use a labelled diagram in your answer.

.....

.....

.....

.....

.....

..... **[6]**

9

(c) Carbonisation is a process that occurs in forest fires. Carbon monoxide is formed and burns with a blue flame.

(i) Explain why carbon monoxide is regarded as a dangerous pollutant.

..... **[1]**

(ii) Nitrogen monoxide is also produced in forest fires. Suggest how it is formed.

.....

..... **[2]**

(iii) In cars, catalytic converters catalyse the reaction of carbon monoxide with nitrogen monoxide, to produce nitrogen and carbon dioxide.

Write an equation for this reaction.

[1]

(iv) There is a change in entropy in many gas reactions.

Explain the term *entropy*.

Describe and explain any entropy change in the reaction in **(iii)**.

.....

.....

.....

.....

..... **[3]**

[Total: 18]

END OF QUESTION PAPER